naturally be asked, What is the cause of this falling-off in the average production? One reason, no doubt, is that some estates are becoming old, and when an unfavourable season occurs their cultivation is temporarily unprofitable. But the main cause is most certainly the fungus (*Hemileia vastatrix*) on the leaves of the plant. This appeared first in 1869, and in 1872 was recognised as a firmly-established coffee pest. It is generally admitted that the injury is caused through the weakening of the tree by the absorption of the juices of the leaf, for no plant has ever been known to be absolutely killed by the attack or even by a succession of them. The first symptom of the disease is a palish discoloration in spots or patches, easily detected when the leaf is held up to the light. These quickly assume a faint yellow colour, and presently become covered with yellow dust, which soon turns into a rich orange. These are the ripened spores of the fungus aggregated in little clusters, and attached to branching filaments, that have found their way from the air-spaces within the leaf, where they have been feeding on its juices and ruining its vitality. It is estimated that there are sufficient of these spores on a badly diseased leaf to infect 100,000 plants, and therefore it is no wonder that the pest, when once it had come to maturity under the favourable conditions of a coffee estate, should spread in an incredibly short space of time over the whole mountain zone, and that probably within less than two years from its first appearance every coffee-tree in the island had been more or less affected by it. The injury in the first instance appears to be done solely to the leaf, which, at a certain stage of the attack, dies of exhaustion, and the tree being an evergreen has to throw out another mass of foliage, which also in its turn becomes affected and dies. Consequently the strength of the plant, which ought to be spent in bearing fruit, is chiefly devoted to putting out new flushes of leaves, whilst a certain percentage of the crop that is at last ripened is found to have suffered from the general weakness of the tree. For a disease of this kind it is impossible to suggest any remedy, such as sulphuring the leaves. Imagine such an operation as sulphuring more than 250,000,000 trees, and then only obtaining a temporary relief! Manure gives a tree strength to bear fruit as well as leaves, and therefore is the most approved of all the remedies tried as yet.

With regard to the origin of the disease, nothing is known, except that it first appeared on a new estate in Madulsima, a district in the south-east of the mountain zone, and bordering on the low country. Mr. Thwaites, the botanist, believes that it has been introduced into the island in imported manure, which is a probable explanation of its origin, so far as Ceylon is concerned. Against this supposition, however, is to be set the fact, according to the writer's belief, that *Hemileia vastatrix* is found in no other country in the world except Southern India, and on no other tree except the coffee-tree. It is, therefore, possible that it may have existed in a modified form, and without attaining any great development on some of the trees in the low country jungle to the eastward, and from them may have been carried by the wind to a neighbouring coffee estate. Be this as it may, it is not now likely that its origin will ever be known, unless future research into the nature of fungi throws a light on the subject which it is impossible to anticipate. As to the future of the coffee enterprise in Ceylon, it is useless to predict. Let us hope that the same Providence which has ordained that masses of plants, animals, or men, may not be unnaturally aggregated together without some disease becoming epidemic among them, may also in this case apply the same law for the destruction of the disease itself, by developing among its countless myriads of spores a principle of death, which may cause the plague to disappear as suddenly and mysteriously as it came.

Since the above was written, the blossoming season has proved so favourable that it is estimated that the crop for the year ending September, 1877, will exceed a million cwts., but whether the plants have suffered so seriously from the attacks of the "leaf disease" as to be unable to bring this crop to maturity time alone can prove.

June, 1876 R. ABBAY

OUR ASTRONOMICAL COLUMN

61 CYGNI.—The following formulæ for the difference of right ascension and declination of the components of 61 Cygni are founded upon a comparison of Bessel's measures with the Königsberg Heliometer (mean epoch, 1835·47) and Baron Dembowski's between 1871 and 1875, on forty-two nights :—

$$\Delta\alpha = +\ 22''\cdot1727 + [8\cdot74448]\,(t - 1870)$$
$$\Delta\delta = -\ 7''\cdot4928 - [9\cdot27780]\,(t - 1870)$$

If the angles of position and distances are calculated from the differences of right ascension and declination thus obtained for the epochs of the older observations, collected by Bessel in his earlier memoir, it will be found that there remains but a very doubtful deviation from rectilinear motion. Bradley's observations, 1753·8, exhibit the largest difference, 3°·9, but having regard to the discordance between the result from Piazzi's observations for 1806·3 and Bessel's for 1812·9, both of which can hardly be correct, this difference is not excessive. It appears that the only suspicion of curvature of path must depend upon these early and more uncertain data, as, indeed, was inferred by Mr. Wilson, of Rugby, some time since.

TUTTLE'S COMET.—The calculations of Clausen and Tischler have placed the theory of this comet upon a very satisfactory foundation. Discovered in the first instance by Mechain, at Paris, on January 9, 1790, it was observed until February 1 ; a parabolic orbit was computed by the discoverer, which subsequently figured in all our catalogues, but there appears not to have been at that time any suspicion of its comparatively short period; indeed, the short extent of observation might well prevent this. On January 4, 1858, the comet was re-detected by Mr. Tuttle, of the U.S. Navy, at the Observatory of Harvard College ; the first elements calculated in this year presented so great a resemblance to Mechain's for the comet of 1790, that the identity of the bodies was immediately inferred, and successive approximations to the period of revolution by Pape and Bruhns, showed that in the sixty-eight years' interval there must have been performed several revolutions, the latter finally concluding that the comet had returned to perihelion four times since 1790, though on every occasion it passed unobserved. Clausen (Dorpat Observations, vol. xvi.) calculated the perturbations due to the attraction of Jupiter between 1858 and 1790, and thus carrying back the elements deduced from the observations of 1858 to 1790, found but small differences from those obtained from observation in the latter year, which difference was still further reduced after he had included the effect of Saturn's attraction from 1805, January 30, to 1816, August 24, and from 1831, July 17, to 1843, October 22. Tischler's results are published in his "Inaugural Dissertation"—*Ueber die Bahn von Tuttle's Comet*, Königsberg, 1868. In this able investigation of the young astronomer (who unfortunately lost his life before Metz) elements founded upon the observations of 1858 were used for the calculation of the perturbations, on the method adopted by Bessel for the comet of 1807, from 1858 to 1844, including the effect of Venus, the Earth, Mars, Jupiter, Saturn, and Uranus, and for all the remainder of the interval the effect of Jupiter and Saturn for every 100 days. With these perturbations of the first order, the elements were found for every 600th day, and with these

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corrected figures the perturbations by Jupiter, Saturn, and Uranus, were recalculated. Thus the value of the semi-axis major at perihelion passage in 1790 was determined. Tischler's work, however, did not close here; he subsequently computed the planetary perturbations from 1858 to the last perihelion passage towards the end of 1871, and hence derived elements for that appearance which were found amongst his papers after his death. It may perhaps be convenient, for the sake of reference, if Tischler's orbits for the three perihelion passages at which the comet has thus far been observed, are here transcribed :—

	1790	1858	1871
T	Jan. 30·8702	Feb. 23·5169	Nov. 30·4642
	° ′ ″	° ′ ″	° ′ ″
π	115 42 0	115 50 56	116 4 36
Ω	268 36 34	269 3 4	269 17 12
i	54 6 26	54 24 30	54 17 0
ϕ	55 1 4	55 12 9·9	55 11 25·6
Log. a	0·7619723	0·7585361	0·7601603

The motion is direct. T is the time of perihelion passage for meridian of Greenwich; that for 1871 being the *predicted* time, which appears to have required a correction of + 1^{d}·333 nearly. ϕ is the angle of eccentricity ($e = \sin \phi$), and a the semi-axis major.

It is stated that the calculation of the perturbations of this comet to the next appearance in 1884 has been undertaken by Mr. Stone, of Washington.

FRENCH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

M. DUMAS in his presidential address made some striking remarks on the important place filled by physical science in modern times as contrasted with its former supposed inferiority to literature, philosophy, and art. "Natural science is no longer content with the contemplative attitude which sufficed for Newton and Laplace. Science is now mixed up with all the personal acts of our existence; she interferes in all measures of public interest; industry owes to her its immense prosperity; agriculture is regenerated under her fostering care; commerce is forced to take her discoveries into account; the art of war has been transformed by her; politics is bound to admit her into its councils for the government of states. How could it be otherwise? Have not mechanics, physics, chemistry, the natural sciences, become intelligent and necessary agents for the creation of wealth by labour? Have they not opened the way to all the institutions by which hygiene watches over the health of workers and the salubrity of cities? If comfort is more universal, the life of man more prolonged, wealth better distributed, houses more commodious, furniture and clothing cheaper, the soldier better armed, the finances of the State more prosperous, is it not to the sciences that all this progress is due? It is they that discover in the ground the first new materials, that show to agriculture the most suitable productions, the most efficacious manures, and the most appropriate implements; they that, inventing new processes for industry, put into its hands untiring machines, sometimes gigantic, rivalling in brute force the giants of fable, sometimes delicate, rivalling in nimbleness the hands of fairies. It is the sciences, in fine, that have given to the world the rapid means of communication by land and sea, by the aid of which man takes possession of the terrestrial globe, creating new peoples and flourishing cities where our fathers knew only of barren deserts and uninhabited regions. . . . Science follows you everywhere: breathe, there is chemistry; walk, there is mechanics; at every moment, without thinking of it, we cannot help having to do with her. Whether we wish it or not it is necessary to accept science as a companion, to possess her or to be possessed of her; if you are ignorant you are her slave, if you are skilled she obeys you. The future belongs to science; unfortunate are the people who shut their eyes to this truth."

The work of the various sections was carried on actively throughout the week, and a fair average of good papers seem to have been read, as usual, the section devoted to the medical sciences filling a large space. In the section of Anthropology, M. Tubino read an interesting paper on the Iberian Peninsula, in which he brought out strikingly the great differences which exist between the inhabitants of the various provinces of Spain and Portugal. There is found in the Spanish races no unity of origin or of physique. There is not only dissimilarity, but also antithesis and opposition. M. Tubino endeavoured to show that the same diversity existed in the region of morals, in language, in art, and in the ideas of right and law, and that thus there is really no Spanish race and no means of establishing in the Iberian Peninsula a centralised state. An interesting discussion followed in which M. Broca, while agreeing with M. Tubino's main statements, showed that the same diversities exist in every country that are found in Spain. The only great barriers of states are geographical limits; the idea of race is a delusion and a snare, and no doubt civilisation will come to Spain as it has come to France.

In the Botanical Section Prof. Lanessan explained the results of his organogenic and histologic researches on the foliar appendages of the *Rubiaceæ*. Prof. Haeckel spoke of some facts relative to the structure of the glands of some plants called carnivorous. The glands described by Darwin as dissolving and absorbing, are found on the inferior face of *Pinguicula vulgaris* and of *Nuphar pumilum*, where they are unicellular. The cellules of these glands present the phenomenon of protoplasmic aggregation under the influence of slight solutions of ammoniacal salts (one-half per cent.). The same facts are presented in the glandular hairs of *Petunia*, *Sparmannia*, and *Pelargonium*, which dissolve flesh after hypersecretion of the glands. He regards the phenomenon of protoplasmic aggregation as characteristic of absorption, and thinks that there will, perhaps, be room for distinguishing physiological aggregation from the morbid aggregation produced under larger doses of reagents. M. Merget explained the result of his researches in the production of phenomena of gaseous synthesis in vegetables.

An excursion was made on Tuesday morning to the top of the Puy-de-Dôme, in which most of the distinguished members of the Association, several ladies, and a number of English men of science took part. An excellent banquet was provided in a small valley at a short distance from the top. Eleven hundred guests had been invited by the Council-General; eight hundred were present. Many healths were proposed and speeches made.

The construction of the observatory cost 225,000 francs, and 100,000 more are required for the completion of the work, although it is in working order. The expenses have been sustained by the department, and the instruments have been constructed by the government. The house of the keeper and director is a massive building situated at a small distance from the top, and partly protected by rocks. Three lightning conductors have been adapted to it. The observatory is a tower standing on a platform, the communication between which and the house is by a well-staircase seventeen metres deep, and a tunnel thirty-five metres long. On the top of the tower is a movable platform. The view is magnificent, but special precautions will be required in constructing an anemometer which will be able to bear the pressure of the storms. It will be a self-registering one.

The concluding sitting of the session took place at the Hotel de Ville on Friday last, under the presidency of M. Dumas. M. Kuhlman was nominated vice-president for 1877 and president for 1878; M. Perier vice-secretary-

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